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Chapter 8

The Regulation of Space Tourism

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Abstract
Space tourism has to be regulated as a subset of private spaceflight activities, whereby humans are sent to outer space in a fundamentally private context. In addition to space law, air law would be relevant for addressing private spaceflight, but neither regime has at the international level regulated relevant activities to any appreciable extent. They provide little more than a set of guiding overarching principles. Much of the onus of future regulation will fall on the shoulders of individual states, most notably the United States. In the more distant future, this may result in a special international regime, using elements of both space and air law.

Keywords: space law, air law, outer space, airspace, space object, aircraft

Introduction

There is little question that for the general public, space tourism is the most exciting development in the space sector since the Moon landings of half a century ago. The idea that anyone with some money could now actually enjoy a flight into space and back is of obvious appeal to many, whether because they think they have seen it all on Earth or simply because outer space represents the most fascinating experience ever. This is not to say that space tourism is the only exciting new phenomenon in space and space law. One category of initiatives that has recently attracted much attention concerns space mining, the plans to visit celestial bodies such as the Moon and asteroids to harvest their water deposits and/or mineral resources for commercial gain. Space mining, however, is far removed from space tourism even in a literal sense: it focuses not on low-earth orbits but on deep space

missions; the technologies are very different; the operations have little in common; and both the public and the private stakeholders are totally different.

As a consequence, space mining and space tourism are, legally speaking, two entirely different sectors. Unlike in the case of space tourism, air law is totally irrelevant for ownership of celestial bodies and space resources, while key principles of space law such as nonappropriation, avoidance of harmful interference, and sharing of scientific discoveries take the place of such concerns as passenger liability (Tronchetti, 2015b). The same applies to even further-reaching projects such as the long-term settlement of humans in outer space. While private spaceflight in general may well turn out to be the starting point for developments allowing cheaper access to space, which somewhere down the line might support the establishment of human settlements in space, that does not make them into similar activities, whether from a political, economic, technical, operational, or legal perspective (Vaughan, 2017).

Another recent development in terms of space activities, which has received a lot of attention, concerns the US intention to create a national "Space Force." This initiative, however, entirely focuses on military and security considerations and so far does not have a significant impact on the legal discussions on space tourism. Contrary to the militarization issue, space tourism, or even "private spaceflight," is very much about the flight and not the destination and about the passengers rather than what they do (Tronchetti, 2015a).

This chapter seeks to clarify the role of law and regulation in the context of space tourism only. While the value judgement on the extent to which space tourism is a good thing is ultimately not a matter of the law (which merely tends to reflect relevant value judgements), the law is certainly an important tool for both promoting any beneficial aspects of space tourism and curbing any negative ones. The starting point is, of course, that space tourism is a fairly novel phenomenon. So far only seven individuals, who may be considered true space tourists, have flown into outer space; this happened during 2001–2009 (Brannen, 2010, pp. 642, 653; von der Dunk, 2015, pp. 662–663). In 1990, a Japanese journalist flew to the Mir space station; he is generally considered the first nonprofessional astronaut but not a true space tourist (Negoda, 2003, pp. 90–91).

This contribution will first address the proper definitions of space tourism before moving into the legal analysis. Following this, it is argued that space tourism and the related broader notion of private commercial spaceflight, having much in common not only with space activities but also with certain types of aviation, would most obviously seem to fall within the scope of space and air law. In addition, the sector would obviously encompass characteristics of tourism and high-adventure sports as well. However, the legal aspects of these activities are essentially *national* in nature and not comparable to the profound *internationalization* of the law in the realms of space activities and aviation. The more mundane aspects (such as bookings, reservations, and cancellation and refund policies), which apply to tourism of any kind, will be largely taken for granted and by and large apply to space tourism as they would to other tourist activities. While this may be less true of high-adventure sports, the most important aspects thereof—notably, informed consent and liability issues—have been taken care of so far only in one particular case through national legislation as part of a space law approach. Liability issues are more extensively discussed in von der Dunk (2013, pp. 206–207) and Carminati's forthcoming thesis which addresses

more fundamentally such activities as horse riding and downhill skiing and the attendant liability issues in the US legal context.

Therefore, international and national legal regimes will have to be addressed. As space tourist activities are inherently not national in character, they fall under international law. The legal analysis will turn to the handful of countries planning to be involved in the near future in space tourism projects, most notably the United States. We shall analyze how they have implemented the relevant international regimes on the national level. The chapter will then conclude with some more general remarks as to the wider context of space tourism and its potential importance for space activities in general, as well as some thoughts on the most likely future legal developments in these respects.

The Legal Framework for Space Tourism

Space tourism would obviously constitute a subset of tourism, defined by the World Tourist Organization and the UN Statistical Committee in 1994 as "The activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure" (Launius & Jenkins, 2006, p. 255). Unfortunately, the definition as given then actually adds for "business, and other purposes"; this seems to be a rather counterintuitive addition and has to be neglected, since it would effectively equate tourism with *all* travel and take away any distinctive traits. Launius and Jenkins, in their extended historical expose, do not refer to *all* travel but merely to what for purposes that everyone would agree constitute tourism properly speaking. This means that tourism requires the availability of three elements:

> (1) a discretionary income available for leisure travel; (2) ample leisure time to spend on both preparations for and taking the trips themselves; and (3) an infrastructure supporting tourism that offers accommodations, food and amenities, transportation systems, and attractions to see and do at the place visited. (Launius & Jenkins, 2006, p. 254; see also Loizou, 2006, p. 289; Smith & Hörl, 2004, p. 37)

Since space tourism is a novel phenomenon, so far no authoritative definition of it has been agreed upon (von der Dunk, 2008). It follows from the aforementioned WTO definition, however, that it would make most sense to simply define it as "the activities of persons traveling to, and staying in, outer space for leisure," as long as we interpret leisure in the broad sense as a notion complementary to and mutually exclusive of business and other professional activities.

Such a definition fundamentally refers to the *reason* for private individuals to undertake tourist activities, which upon closer look is not primarily a legally decisive criterion. To use the often-made comparison with aviation here, aircraft can carry tourists; persons taking a flight because they are crazy about flying or want to spend their holidays far away from home; and passengers who merely need to go to another place for business or professional reasons as safely, quickly, and/or cheaply as possible. Yet, legally speaking all of them are equal in terms of aviation law—whether it concerns the need to comply with

applicable laws onboard, contractual liability, consumer rights, or the need to bring a valid passport.

The more distinctive criterion, therefore, is not the *reason* for undertaking certain activities but *who* offers and undertakes them. The legally more relevant concept is that of *private* (human) spaceflight, of which space tourism then forms a specific subset. Given the enormous sums that spaceflight still requires, it is for the time being very unlikely for governments to fund and operate such flights merely for purposes of tourism (for a discussion of why NASA started to strongly support private initiatives in commercial spaceflight, see Brannen, 2010, pp. 660–668).

"Private human spaceflight" has been defined as:

> flights of humans intended to enter outer space (a) at their own expense or that of another private person or private entity, (b) conducted by private entities, or (c) both. (von der Dunk, 2015, p. 667)

In terms of both space tourism and private spaceflight, a further distinction then arises between orbital and suborbital activities. Since orbital is a rather straightforward operational/technical criterion, referring to the achievement of at least one full orbit around the Earth, it would make the most sense to define suborbital as the corollary to orbital, or a flight that does *not* achieve at least one full orbit around the Earth. Unfortunately, the actual use of the term suborbital has led to much confusion causing the above definition to require considerable further adjustment (von der Dunk, 2015, pp. 667–672). However, for the purpose of discussing space tourism as the main subset of private spaceflight, that definition would still suffice.

This means that there are currently two relevant types of private spaceflight, giving rise to a similar dichotomy within space tourism. The first concerns private orbital spaceflight, whereby private spaceflights achieve (or at least intend to achieve) an orbit around the earth. This comprises, first, the crewed flights soon to be flown by private operators carrying professional astronauts for NASA to the International Space Station (ISS) under the Commercial Crew Development program (a NASA concept for supporting and co-funding the development of private spaceflight capabilities to replace the role of the Space Shuttle, which was retired in 2010; see von der Dunk, 2015, pp. 664–665 and pp. 702–705). Second, it includes the eight flights that have so far carried actual tourists to the ISS (von der Dunk, 2015, p. 663; Sharpe & Tronchetti, 2015, pp. 646–652).

Commercial crew development has not yet been finalized, and it looks unlikely for the time being that there will be additional tourists willing and able to pay the price for a trip to the ISS, whereas the development of a private space hotel—a yet more futuristic element of orbital tourism—still seems some years away as well. Furthermore, these development plans are unique to the United States; there is no other country or area where substantial plans to develop private orbital spaceflight capabilities are currently under development. In the other major spacefaring countries, such as Russia, China, or India, there is no private space sector of note, whereas in other parts of the world where the private sector in general *does* play a role in space activities, such as Japan, Canada, Australia, and the major Western European countries, the interests generally lie elsewhere. For these reasons, the present

contribution will focus on suborbital private spaceflight including suborbital private space tourism.

The category of private suborbital spaceflight can be defined as spaceflights *not* achieving or intended to achieve the Earth orbit. Within that category, the suborbital space tourism flights currently on the verge of being realized by the likes of Virgin Galactic and Blue Origin clearly dominate the discussion, although nontourist activities, such as training flights for government astronauts or small scientific experiments, are also seriously contemplated. Developments here largely focus on the United States. Though several European countries are also working toward involvement in the future of private suborbital spaceflight, they so far still seem to depend exclusively on the US initiatives. That even more applies to countries outside of Europe, such as the United Arab Emirates, Japan, South Korea, and Singapore, where plans to become involved in such private US initiatives are at best in the stage of initial consideration. In practice, therefore, the analysis will focus very much on accompanying legal and regulatory developments in the United States and Europe.

Regulating Suborbital Space

Any analysis and discussion of which law and regulation already applies to suborbital private spaceflight and space tourism, respectively, and what law and regulation ought to be further developed, should start from the fundamental understanding that as a quite novel set of human activities these flights do not easily fit into any existing category, either within space activities and space law or within aviation and air law. Consequently, there does not exist a tailor-made legal regime developed exclusively for this new sector. The only thing which can be safely said at the outset is that the global character of both space activities and, generally, aviation means that any analysis of existing law and development of future regulation should preferably and primarily focus on international law as opposed to domestic law, limited to respective single nations. In fact, international space and air law serve to determine the scope for such national laws. Even if only as a baseline framework, the general rules and principles of existing international space law and international air law as a *lex generalis* would apply to private spaceflight in the absence precisely of such tailor-made *lex specialis*. Orbital private spaceflight and orbital space tourism are currently, and indeed should be exclusively and primarily regulated as space activities, presuming application of space law. By contrast, while those about to provide private spaceflight opportunities indeed sell them as *space*flights (notably, passengers are promised to become astronauts by reaching the altitude of some 110 km above the Earth's surface), air law is an issue for those flights for two main reasons.

On the one hand, any activities involving transporting vehicles into space and, if relevant, back to Earth, requires the transition of airspace on the way to outer space and on the way back. Safety reasons alone would require proper integration into existing rules of air law dictating the use of airspace. The ad hoc approach of creating launch windows for a limited time and a limited area may have worked for highly intermittent space launches in the past, but if private commercial spaceflight were to really take off such an approach would no longer be feasible.

On the other hand, the nature of the planned suborbital private flights shows much similarity with the early days of aviation in terms of the experimental and sensational character and the absence of real transportation. The customers of Virgin Galactic and Blue Origin will land on the same spot from where they took off, just like the old sightseeing flights comprising a major part of aviation activities in its infant stages a century ago. Beyond that, the ultimate aim of suborbital spaceflight operators is often to prepare the technology for later use in transporting passengers from one place on the Earth to another—which then resembles actual aviation (von der Dunk, 2008, pp. 403–408). Finally, much of the technology involved in those flights is either derived from aviation technology or, for instance in the case of Virgin Galactic, even uses aircraft for the first stage of the flight. All of this raises the more fundamental question whether air law should, would, and/or could be applied to the whole suborbital operation (whereas in the case of orbital operations obviously at least the orbital part would in principle also be subject to space law).

How fundamental the choice would be between space and air laws, how they allocate jurisdiction to states for the purpose of regulating and controlling activities, and how different the results of their respective application would be are illustrated here by focusing on four important aspects of private suborbital spaceflight operations, which would have to be taken care of by regulation: first, there is the issue of licensing operators (as space companies, airports, or airlines?); second, the issue of crew licensing (as astronauts or pilots?); third, there is a necessity to certify the vehicle (as a spacecraft or an aircraft?); and fourth, there must be a liability regime to address the occurrence of damage (damage caused by a spacecraft or an aircraft?). If one manages to regulate those in a proper and thorough manner, all other safety- and security-related environmental and other public concerns should be duly taken care of. When it comes to the issue of applying international space law versus international air law, with a view both to existing regulation and to future regulation, the application of either regime would be triggered by two major operational facts: the vehicles used and the areas where such usage takes place. Indeed, it will make a major difference whether we would apply international space law or international air law.

Space Law versus Air Law

As to the operation of the vehicles concerned, the application of much of space law's rules is premised on the involvement of a "space object." Unfortunately, this concept has not really been defined by international (space) law. The partially circular definition that a space object "includes [its] component parts [. . .] as well as its launch vehicle and parts thereof" is not really helpful in this respect. Looking more closely at the way the terms "object (launched into outer space)" and "space object" have been used in the main space treaties of global scope, there is a growing consensus that a space object would best be defined as "any man-made artefact intended to be flown to an altitude generally considered outer space" (von der Dunk, 2015, p. 679). This definition avoids a discussion on the altitude at which outer space is legally speaking considered to begin.

The applicability of national or international air law hinges on the involvement of an aircraft in the activities concerned. "Aircraft" in this context is defined quite precisely by international air law (a definition also applied in most national laws dealing with aviation as well) as "any machine that derive support in the atmosphere from the reactions of the

air other than the reactions of the air against the earth's surface" (Convention on International Civil Aviation 1944, hereafter Chicago Convention, Chicago, 1944, Annex 7). In other words, anything with wings or rotors, as well as hot air balloons, qualifies as aircraft for the purposes of air law.

Looking at the current prototypes being developed for private suborbital spaceflight and assuming that the altitudes they aim for constitute outer space, *all* of them would qualify as space objects as defined earlier. However, in addition, vehicles under development such as the SpaceShipTwo, with wings used in the last phase of flight, would *also* qualify as aircraft under the International Civil Aviation Organization (ICAO) definition. Even more confusingly, in the case of Virgin Galactic the aircraft carrier WhiteKnightTwo, though itself not aiming for anywhere close to outer space (it is supposed to fly to altitudes of no more than some 15–20 km), by effectively being the launch vehicle for the SpaceShipTwo *also* qualifies as a space object.

In short, in several cases, a choice would have to be made between legally considering the vehicle at issue a space object, or alternatively an aircraft, since in principle both definitions might apply, but their simultaneous application would result in confusing and conflicting legal regimes (von der Dunk, 2015, pp. 674–675, 678). This is so because general international space law takes a rather light legal approach to regulating activities undertaken by or involving space objects, whereas, by contrast, air law consists of a very extended, well-weathered, and expansive set of rules detailing under which conditions aircraft can operate.

International space law is triggered by the involvement of a space object. The latter is made subject to such general legal requirements as registration (Convention on Registration of Objects Launched into Outer Space, 1975, hereafter "Registration Convention"), the rules on the object's return to the launching authority (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967, hereafter "Outer Space Treaty," Art. V, Rescue Agreement, 1968), and compliance with the principle of absence of harmful interference to the extent provided for by Article IX of the Outer Space Treaty (Viikari, 2015).

As to the four main aspects of regulation to be taken care of, the licensing of operators of space objects would indeed be subject to some form of "authorization and continuing supervision" by "the appropriate State" (Outer Space Treaty, Art. VI), but no specific further details are provided. It is thus left to individual "appropriate states" how stringent or lenient such authorization would be (Marboe, 2015, pp. 131–132; Zannoni, 2013, pp. 349–353). Nothing is provided by way of licensing the crew; it is entirely left to individual states to determine who might be eligible (for instance, in terms of selection and training) to fly on a space object. International space law only provides for some general rights of astronauts in case of distress or emergencies (Outer Space Treaty, Art. V, Rescue Agreement, Arts. 1–4), but it is doubtful whether these would fully apply to either private crew flying suborbital craft or even more so the passengers on board (Chatzipanagiotis, 2011, pp. 29–38; Sharpe & Tronchetti, 2015, pp. 647–652). Likewise, international space law does not provide any requirements in terms of safety certification of space objects—it is again left entirely to individual states to impose such requirements by way of national space law.

The only one of the four main aspects that is addressed in any detail by international space law is that of liability, and it is indeed crucially tied to the concept of a "space object." Following Article VII of the Outer Space Treaty and the Liability Convention, liability for damage caused in the context of space activities is translated into damage caused by a space object, and this is elaborated in quite some detail. Thus, a distinction is made between absolute liability for damage caused on the Earth or to aircraft in flight and fault liability for damage caused to other space objects in outer space (Convention on International Liability for Damage Caused by Space Objects, London/Moscow/Washington, done on March 29, 1972, hereafter "Liability Convention," Arts. II and III). Compensation for liability is in principle without limits (Liability Convention, Art. XII). The extent of liability is detailed by several clauses (Liability Convention, Arts. I(a) and (c), IV–VI), the right to claim is specified (Liability Convention, Arts. VII, VIII, and XII), and a set of procedures for actual claims is laid down (Liability Convention, Arts. IX–XX).

Crucially, with a view to private spaceflight, this whole regime applies to third-party liability only, that toward persons or entities not involved in the operations themselves. Since the space treaties were developed in an era when the only crewed spaceflight under consideration was a *public* crewed spaceflight, involving only government-employed astronauts and engineers whose potential harm would be covered by their employment contract and/or government regulation, nothing was included on liability toward other humans involved in the flights. The special status of astronauts as a unique, small set of government employees is further borne out by Article V of the Outer Space Treaty, which labels them "envoys of mankind" and requires them being treated with consequential special respect and by the Rescue Agreement which further elaborates the treatment that astronauts are entitled to in particular when in situations of distress or emergencies.

Under international air law, the situation is radically different. The Chicago Convention—like the space treaties—does provide for a range of general requirements pertaining to aircraft such as registration (Chicago Convention, Arts. 17, 18, and 21), documentation, and equipment to be carried on board (Chicago Convention, Arts. 29 and 30), and the rights and obligations aircraft have in the context of international aviation operations (Chicago Convention, Arts. 5, 7, 8, 11, and 12). These are often elaborated in great details by the Annexes to the Chicago Convention which provide for Standards and Recommended Practices (SARPs), of which the former constitutes binding law upon the member states (Chicago Convention, Art. 37).

As to operator licensing, the Chicago Convention—like the Outer Space Treaty—leaves it to states parties to use or not the specific tool of operator licensing. Due to the extended requirements that aircraft have to comply with, as per the Chicago Convention, it has become almost inevitable for states to also use operator licensing at a national level. Indeed, this has become standard practice in most states (Diederiks-Verschoor, 2012, pp. 254–259; Milde, 2016, pp. 89–95).

One major set of such requirements also concerns the second main aspect of crew licensing. According to the Chicago Convention (Art. 32(a)), the pilot of every aircraft and the other members of the operating crew of every aircraft engaged in international navigation shall be provided with certificates of competency and licenses issued or rendered valid by the State in which the aircraft is registered. Other states have the right, in principle, to

refuse such licenses—which in practice translates into a general stimulus for national crew licensing regulation to be taken very seriously (Chicago Convention, Art. 32(b)). Similarly, the third main aspect, craft certification, is taken care of in broad terms by the Convention, as "[e]very aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued or rendered valid by the State in which it is registered" (Chicago Convention, Art. 31). This is then further elaborated and updated in great detail through Annex 8 on "Airworthiness."

Finally, as to liability, international aviation law provides not only for third party but also for passenger liability, linking the occurrence of damage directly to the aircraft causing it. States party to the respective treaties then must implement such international law in their relevant national legislation. Third-party liability is covered by the 1952 Rome Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, 1952 (hereafter "Rome Convention"), as later amended by the 1978 Montreal Protocol to Amend the Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, 1978 (hereafter "Montreal Protocol"). A 2009 Convention (Convention on Compensation for Damage Caused by Aircraft to Third Parties, Montreal, 2009) has not yet entered into force. Since the number of states parties to the Rome Convention and the Montreal Protocol is limited, national law is still applicable in the majority of instances.

As for passenger liability, the international regime ranges from the 1929 Warsaw Convention (1929) to the 1999 Montreal Convention (2003). It effectively imposes upon states parties the obligation to harmonize relevant national law requiring aircraft operators to compensate damage caused to passengers and cargo on board of aircraft in accordance with whatever terms the relevant treaty regime prescribes. Which treaty is applicable precisely in which given case is not determined by the partisanship of the state in whose airspace a particular aircraft happens to be flying at the time of the incident but rather by the partisanship of the states of departure and arrival of the flight at issue (Warsaw Convention, Art. 1(2); Montreal Convention, Art. 1(2)).

This analysis shows that it is of crucial importance for private suborbital spaceflight, including space tourism, whether the vehicles planned to be used were to be defined and viewed as space objects or aircraft. Looking at the design and operational features of the current drawing board prototypes, all of them would qualify as space objects, yet most of them would also qualify as aircraft (Hughes & Rosenberg, 2005; van Fenema, 2005, pp. 400–403; Vissepó , 2005, pp. 79–84). Within Europe, this situation even gave rise to semiofficial efforts by the European Aviation Safety Agency to develop an appropriately specific certification regime for the craft to engage in suborbital flights (at least to the extent that these qualify as aircraft) and, once that regime was sufficiently developed, to start addressing attendant safety issues such as those related to crew and passenger licensing and certification (Marciacq, Morier, Tomasello, Erdelyi, & Gerhard, 2010).

Outer Space versus Airspace

As to the areas of operation, the difference between the status of outer space and the underlying airspace starts already with the fundamentally different international legal status of the two realms, raising the problem of how individual states could exercise jurisdiction over relevant activities out there. One consequence of this very fundamental difference is

that, at least in principle, a boundary line should be acknowledged where the sovereignty of the underlying state gives way to the freedom of outer space. While currently no international (legal) agreement exists on a specific altitude at which such a boundary would be set—or even about the need for such a specific boundary—a consensus is gradually emerging that the most agreeable altitude would be 100 km (von der Dunk, 2015).

Outer space is generally conceived to be a global commons: an area outside of the territorial jurisdiction of *any* state (Outer Space Treaty, Art. II) and an area where freedom of exploration and use (Outer Space Treaty, Art. I) is the baseline legal principle. Limitations to that freedom can be agreed upon only at the international level by such treaties as the Outer Space Treaty itself or customary international law. This means that activities in that realm can be legally controlled only by states, which are also responsible and liable for private activities out there (Outer Space Treaty, Arts. VI, VII).

First, to the extent that such activities are remote-controlled, that is with the key actor located somewhere on Earth, normally territorial jurisdiction can still be applied *to actors on national territory even if the activities themselves take place in outer space* (Boas, 2012, pp. 251–255; Wallace, 1997, pp. 112–117). Second, states can (continue to) exercise jurisdiction based on the nationality of the actors, whether natural or legal persons (Boas, 2012, pp. 255–258; Wallace, 1997, pp. 114–115). While there may be issues with enforcing jurisdiction if such nationals are physically outside the country, in principle nationality-based jurisdiction can be exercised vis-à-vis their activities regardless of where they would be undertaken (including in outer space). Third, following the provisions of Article VIII of the Outer Space Treaty and the Registration Convention, states can exercise quasiterritorial jurisdiction over space objects registered by them as well as over "any personnel thereof" (Outer Space Treaty, Art. VIII). However, for instance, in terms of traffic management, the only feasible solution would be an international regime, even if specific tasks within a space traffic management regime for a special area might be allocated to a single state. This resembles air traffic management over international waters being allocated to specific nations (von der Dunk, 2016, p. 385). In other areas an international regime would also clearly be preferable over a hodgepodge of national laws, each applicable to only some pieces of the puzzle. Operator licensing, the only aspect of private spaceflight where space law does provide some potential legal tools, has already been discussed as being linked to the operation of a space object. At the same time, however, the scope of Article VI of the Outer Space Treaty is also defined by the area of activities: pursuant to it, international responsibility applies for "national activities *in outer space*" (emphasis added).

A major part of the regime of space law providing limitations to the baseline freedom of exploration and use of outer space (Outer Space Treaty, Arts. I and II) also applies to the geographical realm of outer space as such. That goes for instance for the fallback clause requiring compliance with general international law (Outer Space Treaty, Art. III), the prohibitions to orbit or station weapons of mass destruction in outer space (Outer Space Treaty, Art. IV), the principles regarding harmful interference with other states' activities (Outer Space Treaty, Art. IX), and the need to inform the United Nations and the scientific community about activities conducted in that realm (Outer Space Treaty, Art. XI).

In contrast to the global commons of outer space, the airspace around the globe is partitioned in sovereign airspaces belonging to the underlying states (Chicago Convention,

Art. 1, also Arts. 2, 5–16) the remainder being international airspace (Chicago Convention, Art. 12). This means that each individual state can legally control or even completely prohibit access to its own airspace, whether for safety of aviation, national security, or economic reasons. Contrary to the situation in outer space, territorial sovereignty can be exercised comprehensively by the underlying state over its air space and in principle even overrides any exercise of jurisdiction over nationals or quasiterritorial jurisdiction over aircraft.

Air law was originally developed at the national level. But the international character of aviation gave rise to a body of *international* air law, the ultimate role of which is to harmonize or at least align as much as possible national legislation for the purpose of enhancing the safety of international aviation. This means that, once such treaties have achieved widespread acceptance by the respective states, their national sovereignty to legislate became subjugated to the international legal standards agreed to under the treaty. Hence, many rules of international air law will then apply to the realm of national airspace and the activities taking place therein, in accordance with the Chicago Convention, which imposes upon the states obligations to ensure that their national legislation is in conformity with international rules. For instance, the clause on scheduled services, which forms the baseline for global commercial operations, requires consent by the sovereign state for any aviation operations in its airspace (Article 6 of the Chicago Convention on the basis of which the worldwide bilateral system of air services agreements allowing reciprocal access to national airspace has been developed [Milde, 2016, pp. 107–127]). Conversely, states retain full responsibility for the safety of aviation in their national airspace (Chicago Convention, Art. 28); they must allow nonscheduled flight in national airspace, subject to certain conditions (Chicago Convention, Art. 5), and are required to apply the rules of the air as elaborated by Annex 2 to the Chicago Convention (Art. 12).

The international conventions of global scope, addressing the application of criminal law, fundamentally hinge on national airspace and on the underlying territory. Thus, the first treaty to address such issues, the 1963 Tokyo Convention, provided that the state, in whose airspace an aircraft registered with another state is flying, is the primary state entitled to exercise its "criminal jurisdiction over an offence committed on board" (Convention on Offences and Certain Other Acts Committed on Board Aircraft, 1963, "hereafter Tokyo Convention," Arts. 1[2], 4). In addition to the vehicle used being a major trigger of space law and air law, the area where a certain activity takes place constitutes the other major trigger of space law or air law, sometimes in combination and sometimes potentially in conflict. Therefore, the choice in either case is obviously of great importance in practice, and so is the as-of-yet undecided question at what altitude airspace ends and outer space begins.

The US Domestic Approach

The only state that has so far taken substantive steps to address private spaceflight, including private suborbital spaceflight and space tourism, is the United States. Once the race for the XPRIZE was won in 2004 by Scaled Composites, it was clear that private suborbital flight was around the corner and that the United States needed to develop a proper legal and regulatory framework to quickly address it.

The main choice which had to be made was between an approach primarily addressing private suborbital flight as a peculiar kind of space activities and one primarily addressing it as a special branch of aviation. The United States circumvented the outer space versus airspace conundrum by defining and addressing suborbital vehicles as a single category, regardless of where they operate, and thereby avoided the need to take a formal position on any boundary line at any altitude, which also allowed it to create a single legal regime for the whole suborbital flight. Beyond that, the United States essentially opted for the space law approach. It did this by going back to the Commercial Space Launch Act (1984) which had allowed private involvement in the launch service sector. So far, that had concerned uncrewed launches only, either undertaken from US territory or undertaken by US operators elsewhere. Amendments in 1988 fine-tuned the liability regime, so far, however, still only for unmanned private launches.

As a first step toward addressing private manned launches, in 1998 the Commercial Space Act was purportedly amended "to address liability and government indemnification concerns and to address licensing authority for RLVs [reusable launch vehicles]" (Hughes & Rosenberg, 2005, p. 4). This gave the FAA the competence to license reentry operations of any object in outer space in addition to launches sending those objects there. Second, the requirement to

> encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States (51 U.S.C., § 50901(a)(7))

resulted in further amendments, now formally incorporating crewed launches into the regime. This was done in 2004, in the Commercial Space Launch Amendments Act amending the 1984/1988 Act, and in 2015 in some further refinements as per Title I of the US Commercial Space Launch Competitiveness Act (2015). Yet further details were (to be) provided by the Code of Federal Regulations.

Thereby, the obligation to obtain a license from the Office of the Associate Administrator for Commercial Space Transportation within the FAA now also pertained to each launch and/or reentry of a vehicle intended for suborbital spaceflight, and the option of obtaining an experimental permit for test flights was created for any private company with US nationality or launching from US territory. Conditions for the grant of a license addressed safety, national security, and compliance with international law. However, there was no certification of the spacecraft used for the launches—the safety considerations were taken care of through the licensing of the launch itself. Effectively, further-reaching safety-related measures such as developing standards for certification are by law currently excluded until October 2023.

With regard to liability, under the original 1984/1988 Act licenses were to include specific obligations to cover third-party liability or liability for the use of governmental launch facilities resulting from accidents; but, as no crewed launches had been foreseen at the time, contractual (passenger) liability was not provided for. Following the 2004 amendments,

the existing third-party and interparty (vis-à-vis the US government) liability regimes continued to apply.

Operators were allowed to fly spaceflight participants without any statutory obligation to accept liability for damage caused to them, as long as all had signed an informed consent clause indicating they were aware of probable accidents and "that the United States Government has not certified the launch vehicle as safe for carrying [. . .] space flight participants" (51 U.S.C., § 50905(b)(5)(B)). This "informed consent" regime, however, resulted in considerable uncertainty as to whether this also would amount to a waiver of contractual liability vis-à-vis spaceflight participants (Knutson, 2007). So, in 2015 the Commercial Space Launch Competitiveness Act redressed this omission and ensured that spaceflight participants are included in the cross-waiver. This means there is effectively no statutory obligation to accept contractual liability on the part of the spaceflight operators—quite contrary to common aviation practice. This regime is also temporary in nature, as a sunset clause currently refers to September 30, 2025, as the date at which a more aviation-like regime could come to be implemented (Commercial Space Launch Competitiveness Act, Sec. 10).

As to the crew, which was also included in the legal regime by the 2004 amendments, operators essentially had to comply with an "informed consent-light regime." This means that crew can also be flown, if duly informed "that the United States Government has not certified the launch vehicle as safe for carrying crew" (51 U.S.C., § 50905(b)(4)(B)), and if it was ensured that "the crew has received training and has satisfied medical or other standards specified in the license or permit in accordance with regulations promulgated by the Secretary" (51 U.S.C., § 50905(b)(4)(A)). This meant that it is largely up to the operator to determine training and other standards.

If by 2025 (for contractual liability) and 2023 (for certification) the spaceflight industry still has not yet taken off in any substantive manner, the aforementioned sunset clauses might be expected to be once again extended. Only once private commercial spaceflight will be considered a mature industry would it become appropriate to start developing statutory and mandatory approaches to passenger liability and safety certification along the lines of the aviation industry.

A final development of note concerns the possibility of government astronauts flying on such private vehicles (von der Dunk, 2015, pp. 703–705). The hybridization of private flights carrying public employees into outer space gave rise to discussion on the extent to which NASA would accept its astronauts and any foreign guest astronauts to fly on vehicles "not certified [. . .] as safe for carrying crew or space flight participants" (51 USC, § 50905 (b)(4)(B) and (5)(B)). Section 112 of the Commercial Space Launch Competitiveness Act, by creating a third category next to crew and space flight participants of government astronauts, has now opened the door to develop special procedures and rules for private commercial spaceflights with such astronauts on board (Mirmina, 2015, pp. 669–678).

A European Approach

Outside of the United States, the main region where substantive progress has been made toward suborbital private spaceflight, including space tourism is Europe; various projects intended to offer such flights have been developed in Sweden, the Netherlands (albeit for a non-European part of the country, the Caribbean island of Curaçao), England and

Scotland, France and Spain, in particular the autonomous region of Catalonia. The largest European aerospace consortium, EADS/Airbus, has announced its plans to develop a vehicle for such purposes.

Following the lead of the United States, it would make most sense for any regulation of space tourism in Europe (whether at the national level or at an EU level) to agree with the US approach of addressing space tourism activities as spaceflight activities. As will be shown below, this was also initially the approach taken. However, later developments cast considerable doubt on its legitimacy and caused considerable problems in establishing any regulation.

In Sweden, where efforts focus on using the Kiruna launch site for space tourism, since 1982 an Act on Space Activities regulates the legal aspects of the whole range of space activities conducted by the private sector. Pursuant to it, a license is required for such activities conducted from Sweden by any operator as well as conducted elsewhere by Swedish operators, with attendant obligations phrased in very broad and abstract terms. The Act, however, was never specifically elaborated for space tourism. Therefore, it contained no provisions relevant for crew licensing or vehicle certification. As to liability, only international third-party liability, not passenger liability, was dealt with. The licensee was required to provide full reimbursement of international claims to be paid by Sweden "unless special reasons tell against this" (Act on Space Activities, 1982, hereafter "Swedish Act on Space Activities"). More recently, as a consequence of European developments addressed further below, discussions on the possible alternative application of national and international air law arose, with the basic result that so far no clear-cut regime seems to exist in Sweden.

As for Curaçao, part of the Kingdom of the Netherlands, it should be noted that the latter has a national space law in place since 2007, requiring a license for launch, flight operation, or guidance of space objects in outer space if undertaken from Dutch territory, ships, or aircraft. Its scope could under circumstances be extended to Dutch operators active elsewhere. While the license will include safety, security, and other related conditions and also require the licensee to fully reimburse Dutch government for any international third-party liability claims, this law has not been adapted to private spaceflight or space tourism. There is no requirement for passenger liability, crew licensing, or vehicle certification.

While no directly relevant specifics are provided, the licensing requirement could be made to apply to space activities organized from the Netherlands, which would possibly enable the application of the law to such activities, undertaken from Curaçao. However, for political reasons, the Dutch law has not been applied to the non-European territory of the country (von der Dunk, 2011, pp. 351–354). As a consequence, regional space regulation is currently under development for Curaçao only, which will likely follow the US approach by addressing space tourism as part of private commercial spaceflight. To the extent these flights would be conducted by US operators, who are closest to market, they would anyway require a license under US law.

In England and Scotland, both (still) part of the United Kingdom, the various projects hatched there would originally have been ruled by the 1986 Outer Space Act, which required a license from UK operators interested in launching, procurement, or operation of

a space object, or undertaking any other activity in outer space—hence, in principle also for tourist activities (Outer Space Act, 1986, hereafter "UK Outer Space Act," chapter 38, Secs. 1, 2). However, once again these were neither specifically mentioned nor addressed by that Act, and there were no crew or vehicle certification clauses. While the licensee was subject to a liability regime, this pertained only to reimbursing the UK government for international third-party liability claims.

When, however, the projects for private suborbital flights recently became more serious and were focusing on flying from the United Kingdom and even inviting non-UK operators to come to the country to do so, it was recognized that such space activities would not be comprehensively covered by the Outer Space Act. The Space Industry Act was adopted to remedy that situation (Space Industry Act, 2018, hereafter "UK Space Industry Act"). Applying to activities conducted from UK territory, this Act addressed private spaceflight in particular *à la* the United States; no crew licensing or vehicle certification clauses were included, but the Act did include a requirement of "informed consent" waiving any liability toward passengers (UK Space Industry Act, Secs. 17, 34(3)). However, the legal regime became slightly hybridized in that the UK Civil Aviation Authority is now the licensing authority, taking over from the UK *Space* Agency, which had this authority under the Outer Space Act.

In France, a domestic Law on Space Operations is in place since 2008; it requires an authorization for launching or returning space objects from French operators and (as for launch and return only) for activities undertaken by any operator from this country (*Loi relative aux opérations spatiales*, hereafter "French Law on Space Operations," Arts. 1, 2). The French Law on Space Operations does not include any conditions regarding crew licensing or vehicle certification, but it does include the standard provisions on international third-party liability.

This so far suggests that the law, like the other national laws of European countries discussed here, does not specifically address, and perhaps was even not intended to address, private spaceflight. However, the French Law on Space Operations also contains clauses providing for a cross-waiver of liability between "persons having taken part in the space operation or in the production of the space object which caused the damage," unless "willful misconduct" would be at issue. It also provides for such a cross-waiver in case of damage "caused by a space operation [. . .] to a person taking part in this space operation," unless the contract specifies otherwise (French Law on Space Operations, Art. 19). Without any further guidance or jurisprudence, this could well apply to passengers on private spaceflights, making France the third country (after the United States and the United Kingdom) having addressed the specific legal aspects of space tourism.

Catalonia, the last region of Europe where space tourism flights are seriously considered, is of course a part of Spain; here, the basic problem is that Spain does not have a national space law nor does it look like it will have one anytime soon. This may not exclude the possibility, given a certain level of autonomy to Catalonia, of the creation of a regional space regulation for Catalonia alone. However, it also does not prejudge any possible application of national Spanish aviation legislation, which would likely bring with it crew licensing, vehicle certification, and liability toward spaceflight passengers.

Finally, a major part of the confusion in several countries as to the correct approach to spaceflight regulation derives from the efforts of the European Union to become involved in this sector. The 2007 Treaty of Lisbon provided for an "EU space competence" by creating a clause stating: "the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space program, excluding any harmonization of the laws and regulations of the Member States (Treaty establishing the European Community as amended by the Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, 2007, hereafter "Treaty on the Functioning of the European Union," Art. 189(2)).

The last phrase in this clause casts major doubts as to the competence of the EU institutions to address, at a European level, the licensing of private spaceflight including space tourism operators. While arguably only France (since 2008) and more unequivocally the United Kingdom (with the enactment of the 2018 Space Industry Act) have addressed private spaceflight, seven more among the EU member states have national space legislation in force addressing the licensing of private space activities as such in general terms.

Therefore, the Commission considered the possibility of rather using its *aviation*-related competences to work for an EU-wide spaceflight regime. As indicated earlier, the European Aviation Safety Agency (EASA) for a few years explored the options to use the EU-wide competence to address the safety aspects of aviation, including those addressing certification of aircraft to apply to suborbital flight (Marciacq et al., 2010, pp. 187–212; van Fenema, 2005, pp. 400–401). Apart from the fact that the EASA competence, as part of the EU transport competence, does *not* extend outside Europe and would thus not apply to Curaçao, it quickly became clear that such an approach—essentially addressing private suborbital spaceflight as a special kind of aviation rather than of space activities—would not square well with the US approach and might by that token result in stifling any European efforts rather than stimulating them. It was no accident that Virgin Galactic, originally a UK company, also in a legal sense moved its operations to the United States and that the efforts in Curaçao, driven originally by a Dutch business initiative but using US technology (von der Dunk, 2011, pp. 349–350), were effectively taken over by the US partner, XCOR (until that company went bankrupt). In any event, the EU efforts were shelved in 2011, leaving uncertainty as to whether any EU regime in this area was considered desirable and feasible or whether individual states could choose their own approach—which some have started to do.

Conclusion

Whether addressing private commercial spaceflight as the more appropriate legal category or space tourism as the currently more visible and attention-attracting subset thereof, regulation at this stage remains, at best, embryonic. The sector is a very international, or indeed global, one. However, while the general rights, obligations, rules, and principles of public international law would indeed apply to this sector, this is far from sufficient to speak of any proper regulation.

Beyond a few very general and broad principles, such as State sovereignty over national airspace, the absence thereof over outer space, and State jurisdiction over craft registered domestically, there is no international agreement to what extent suborbital private spaceflight should be addressed as a space activity, as aviation, or as both—and, if so, where the exact boundaries between application of international space law respectively international air law would have to be drawn. The existing definitions of space objects and aircraft and the existing interpretations of outer space and airspace as geographical realms, the two main sets of triggers of application of the respective regimes, still allow for far too much uncertainty in this respect.

Because of being the country most involved in serious projects developing private commercial spaceflight, including space tourism, and to a considerable extent actually promoting them for more general industrial and space policy purposes, the United States faced a substantial need to step into the gaps left open at the international legal level. The result was new national legislation and regulation primarily treating private commercial spaceflight as *space*flight, even as the door was left open to, over time, insert more aviation-law aspects and elements into the regime.

Europe is really the only other major area in the world where private commercial spaceflight, and to some extent also space tourism, is seriously contemplated and projects have been initiated to develop the necessary technologies and infrastructure. However, while the European Union at least originally tended to opt for a much more aviation- and air law–guided approach, owing partly to the threatening divergence from the US approach the relevant regulatory initiatives have been shelved, if not indeed silently canceled. As a result, the few European states still interested in private commercial spaceflight are currently developing their own idiosyncratic approaches, to more or lesser extents following the US approach.

From a theoretical perspective, both space law and air law being very much international in character (albeit from the opposite starting points of absence of territorial sovereignty and presence thereof respectively), it would of course make most sense to address private commercial spaceflight (and perhaps to a lesser degree also space tourism) at a global level as one coherent sector and determine at that same global level the extent to which the regulation thereof should be taken care of principally by space law, air law, or a mix thereof. Equally, from this perspective, it would be desirable to have such regulation enshrined in an international treaty of some sort.

However, the reality is that since the mid-seventies it has not been possible for the international community to agree on space treaties of general scope. Instead of the top-down approach of an internationally agreed treaty, most likely a bottom-up approach will arise, whereby those individual countries (or in the case of Europe, maybe the European Union after all) seriously interested in private commercial spaceflight will develop their own particular legislative and regulatory initiatives, where it may be hoped that those countries will look to existing legislation in other countries in order to not entirely fall out of line with general developments. The United States being first in this realm, its law would set the baseline model for national domestic regulation of the sector—hopefully ultimately to such an extent that a more or less uniform regime of customary international law regarding private commercial spaceflight would arise. Fundamental space law principles such as

state responsibility and state liability, including for private space activities, would then provide some guarantees that the essentially individual approaches of various countries would not result in a race to the bottom, and make sure that ultimately "[t]he exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind [*sic*]" (Outer Space Treaty, Art. I).

References

Boas, G. (2012). *Public International Law*. Northampton, MA: Edward Edgar Publishing.

Brannen, T. (2010). Private commercial space transportation's dependence on space tourism and NASA's responsibility to both. *Journal of Air Law and Commerce, 75*, 639–688.

Chatzipanagiotis, M. (2011). *The legal status of space tourists in the framework of commercial suborbital flights*. Cologne: Karl Heymanns Verlag.

Diederiks-Verschoor, I. H. P. (2012). *An introduction to Air Law* (9th rev. ed). Alphen an den Rijn: Kluwer Law International.

Hughes, T. R., & Rosenberg, E. (2005). Space travel law (and politics): The evolution of the Commercial Space Launch Amendments Act of 2004. *Journal of Space Law, 31*, 1.

Knutson, T. (2007). What is 'informed consent' for space-flight participants in the soon-to-launch space tourism industry? *Journal of Space Law, 33*, 105–122.

Launius, R. D., & Jenkins, D. R. (2006). Is it finally time for space tourism? *Astropolitics, 4*(3), 253–280.

Loizou, J. (2006). Turning space tourism into commercial reality. *Space Policy, 22*(4), 289–290.

Marboe, I. (2015). National space law. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

Marciacq, J. B., Morier, Y., Tomasello, F., Erdelyi, Z., & Gerhard, M. (2010). Accommodating suborbital flights into the EASA regulatory system. In J. N. Pelton & R. S. Jakhu (Eds.) *Space safety, regulations and standards* (pp. 187–212). Waltham, MA: Butterworth-Heinemsan.

Milde, M. (2016). *International air law and ICAO* (3rd ed). Amsterdam: Elsevier International Publishing.

Mirmina, S. C. (2015). Astronauts redefined: The commercial carriage of humans to space and the changing concepts of astronauts under international and U.S. law. *Florida International University Law Review, 10*, 669.

Negoda, S. A. (2003). Legal aspects of the commercial development of the Russian segment of the ISS. *Air and Space Law, 28*, 89.

Sharpe, C., & Tronchetti, F. (2015). Legal aspects of public manned spaceflight. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

Smith, L. J., & Hörl, K. U. (2004). Legal parameters of space tourism. *Proceedings of the Forty-Sixth Colloquium on the Law of Outer Space*. Reston, VA: American Institute of Aeronautics and Astronautics.

Tronchetti, F. (2015a). Legal aspects of the military uses of outer space. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

Tronchetti, F. (2015b). Legal aspects of space resource utilization. In F. G. von der Dunk & F. Tronchetti (Eds.) *Handbook of space law* (pp. 769–813). Northampton, MA: Edward Elgar Publishing.

van Fenema, H. P. (2005). Suborbital flights and ICAO. *Air and Space Law, 30*, 396.

Vaughan, J. (2017). The space kingdom of Asgardia says it's the first nation with 'all of its territory in space'—But space law experts dispute the claim, *Business Insider*, 7 December. Retrieved from https://www.businessinsider.com.au/asgardia-1-satellite-first-country-exist-space-2017-12

Viikari, L. (2015). Environmental aspects of space activities. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

Vissepó, V. J. (2005). Legal aspects of reusable launch vehicles. *Journal of Space Law, 31*, 85.

von der Dunk, F. (2011). Space tourism, private spaceflight and the law: Key aspects. *Space Policy, 27*, 146–152.

von der Dunk, F. G. (2008). Passing the buck to Rogers: International liability issues in private spaceflight. *Nebraska Law Review, 86*, 400–438.

von der Dunk, F. G. (2013). The integrated approach—Regulating private human spaceflight as space activity, aircraft operation, and high-risk adventure tourism. *Acta Astronautica, 92*(2), 199–208.

von der Dunk, F. G. (2015). Legal aspects of private manned spaceflight. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

von der Dunk, F. G. (2016). Space traffic management: A challenge of cosmic proportions. In *Proceedings of the International Institute of Space Law 2015* (Vol. 58). The Hague: Eleven International Publishing.

Wallace, R. M. M. (1997). *International law* (3rd ed). New York, NY: Sweet and Maxwell.

Zannoni, D. (2013). Conflict and conciliation of national space laws. *Annals of Air and Space Law, 38*, 343.